Date:December 09,2009

SANYO

Sanyo Test Report

Name of Sample	Lithium Ion Battery 3LUNA-2-T0595
Consignor	SANYO Energy(Suzhou) CO.,LTD
Manufacturer	SANYO Energy(Suzhou) CO.,LTD
Test Method	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Criterion	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Appearance	Black rectangular parallelepiped
Test Date	2009/10/16 – 2009/11/04
Sample Number	24
Test Items	Altitude simulation, Thermal test, Vibration test, Shock test, External short circuit, Overcharged
Conclusion	The sample has passed the items of UN38.3.
Remark	Certification by Similar Model: Luna_3s2p Ratio of (3LUNA-2-T0595)/(Luna_3s2p) [+]=100%, [-]=100%, [Electrolyte]=100% Same cell
Consignor Address	No.86 Sunwu Road, Xukou, Wuzhong District, Suzhou City, Jiangsu Province 215164, China

Sanyo Electric Co.,LTD
Mobile Energy Company
Battery System Development Management Department
Techinical Administration Department

M. Kawbayashi	M. Komata	M. Takeuchi
Approval	Check	Writing

CONFIDENTIAL

Date:December 09,2009

B:Checklist for Judging New Type Battery or not

Confirmation of presence of change in "The element which is given influence"
(Change ⇒ ○、 No change ⇒ —)
When there is no change in all items, it is NOT considered to be a New Type Battery.

Model which UN regulation test has completed	Luna_3s2p
Target model which is not a new type	3LUNA-2-T0595

Test Item (Function)	The element which is given influence	Presence of change
T1:Altitude Simulation (Decompression load)	・Crimped part, Gasket (Cell) ・Gas Release Vent, Cell Case (Cell) ・Pack (Plastic) Case ・Holding Member(Insulator, Insulation Tape, Both Sides Tape) ・Coating materials	—
T2:Thermal Shock (Repetition of high temp. and low temp.)	・Crimped part, Gasket (Cell) ・Gas Release Vent, Cell Case (Cell) ・Finished state of Wound Electrodes (Cell) ・Pack (Plastic) Case ・Holding Member(Insulator, Insulation Tape, Both Sides Tape) ・Coating materials	—
T3:Vibration (Vibration load)	・Finished state of Wound Electrodes (Cell) ・Electric wiring member ・Electronic Parts on a circuit board ・Cell Holding Member (Adhesive, Both Sides Tape, Lib of Plastic Case)	—
T4:Shock(Shock load)	・Wiring Member ・Electronic Parts on a circuit board ・Cell Holding Member(Adhesive, Both Sides Tape, Lib of Plastic Case) ・Finished state of Wound Electrodes (Cell)	—
T5:External Short Circuit(Short current)	・Over-voltage Protection ・Current Control Device ・Safety Device of cell (Cell) ・Lead Tab	—
T6(Cell):Impact(Crash load)	・Separator (Cell) ・Insulation State in a cell (Cell)	—
T7(Pack):Overcharge(Charge load)	・Overcharge Protection ・Thermal Device ・Safety Device of cell (Cell)	—
Judgment result	New Type or not	New・Not new

Sanyo Electric Co.,LTD
Mobile Energy Company
Battery System Development Management Department
Techinical Administration Department

M. Kobayashi — approval
M. Komata — Check
M. Takeuchi — Writing

E903428 Dec. 09. 2009

Certificate of UN test for Lithium ion battery

Customer Model : AL10C31
Sanyo Model : 3LUNA-2-T0595
Sanyo Product Code : F12430950

SANYO Electric Co.,Ltd.
Mobile Energy Company
Battery System Development
Management Department
M. Kanbayashi Senior Manager
Technical Administration Department

Manual of Tests and Criteria (38.3 Lithium batteries) No.	Test item	Test results	Note	Number of test batteries			
T 1	Altitude simulation	Pass		First cycle fully charged 4 batteries	First cycle fully Discharged 4 batteries	After 50 cycles fully charged 4 batteries	After 50 cycles fully discharged 4 batteries
T 2	Thermal test	Pass					
T 3	Vibration	Pass					
T 4	Shock	Pass					
T 5	External short circuit	Pass					
T 6	Impact	Pass		First cycle 50% charged 5 cells for cylindrical cell, 10 cells for prismatic cell, 5 cells for coin cell.		After 50 cycles, fully discharged 5 cells for cylindrical cell, 10 cells for prismatic cell, 5 cells for coin cell.	
T 7	Overcharge	Pass	For battery only	First cycle fully charged 4 batteries		After 50 cycles, fully charged 4 batteries	
T 8	Forced discharge	—	For cell only	For cell only			

Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating	49 Wh	
Nominal voltage	11.1 V	
Lithium equivalent content	3.96 g	

We declare the above : The test result mentioned above was checked according to UN test.
(Manual of Tests and Criteria ST/SG/AC.10/11/Rev.4, PartIII, sub-section 38.3)

E903428 Dec. 09. 2009

Certificate of Package Drop Test for Lithium ion battery

Customer Model : AL10C31
Sanyo Model : 3LUNA-2-T0595
Sanyo Product Code : F12430950

SANYO Electric Co.,Ltd.
Mobile Energy Company
Battery System Development
Management Department

M. Kanbayashi Senior Manager
Technical Administration Department

Test item	Test results	Note
Package Drop Test	Pass	The package shall be dropped from 1.2meter high onto a concrete surface (flat and horizontal) with five orientations (drop once a sample); (1)flat on the bottom, (2)flat on the top, (3)flat on the long side, (4)flat on the short side, (5)on a corner

Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating	49 Wh	
Nominal voltage	11.1 V	
Lithium equivalent content	3.96 g	

We declare the above : The test result mentioned above was checked according to UN test.
(Model Regulations ST/SG/AC. 10/1/Rev.15, Special Provision188)

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Altitude simulation (T1)

2.Test Purpose: This test simulates air transport under low-pressure conditions.

3.Test Procedure:

Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hours at ambient temperature(20±5℃).

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2009/10/16

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention (%)(=>90	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	**282.15**	**282.11**	0.01	**12.81**	**12.81**	100.0	**0**	PASS	PASS
	2	**282.01**	**281.95**	0.02	**12.81**	**12.81**	100.0	**0**	PASS	
	3	**282.12**	**282.08**	0.01	**12.81**	**12.80**	99.9	**0**	PASS	
	4	**282.16**	**282.12**	0.01	**12.81**	**12.81**	100.0	**0**	PASS	
At first cycle,in fully discharged states	5	**281.99**	**281.97**	0.01				**0**	PASS	
	6	**282.35**	**282.33**	0.01				**0**	PASS	
	7	**282.35**	**282.33**	0.01				**0**	PASS	
	8	**282.38**	**282.35**	0.01				**0**	PASS	
After 50 cycles ending in fully charged states	9	**282.24**	**282.23**	0.00	**12.84**	**12.84**	100.0	**0**	PASS	
	10	**282.08**	**282.06**	0.01	**12.84**	**12.84**	100.0	**0**	PASS	
	11	**281.85**	**281.83**	0.01	**12.84**	**12.84**	100.0	**0**	PASS	
	12	**281.93**	**281.87**	0.02	**12.84**	**12.84**	100.0	**0**	PASS	
After 50 cycles ending in fully discharged states	13	**281.95**	**281.96**	0.00				**0**	PASS	
	14	**282.44**	**282.45**	0.00				**0**	PASS	
	15	**282.21**	**282.21**	0.00				**0**	PASS	
	16	**282.16**	**282.14**	0.01				**0**	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Thermal Test (T2)

2.Test Purpose: This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

3.Test Procedure:

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 75±2 ℃, followed by storage for at least six hours at a test temperature equal to -40±2℃.The maximum time internal between test temperature extremes is 30 minutes.This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ±5 ℃). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2009/10/22

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention (%)(=>90	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	282.11	282.02	0.03	12.81	12.62	98.5	0	PASS	PASS
	2	281.95	281.86	0.03	12.81	12.62	98.5	0	PASS	
	3	282.08	281.99	0.03	12.80	12.62	98.6	0	PASS	
	4	282.12	282.01	0.04	12.81	12.62	98.5	0	PASS	
At first cycle,in fully discharged states	5	281.97	281.84	0.05				0	PASS	
	6	282.33	282.22	0.04				0	PASS	
	7	282.33	282.20	0.05				0	PASS	
	8	282.35	282.24	0.04				0	PASS	
After 50 cycles ending in fully charged states	9	282.23	282.13	0.04	12.84	12.67	98.7	0	PASS	
	10	282.06	281.94	0.04	12.84	12.67	98.7	0	PASS	
	11	281.83	281.71	0.04	12.84	12.66	98.6	0	PASS	
	12	281.87	281.77	0.04	12.84	12.67	98.7	0	PASS	
After 50 cycles ending in fully discharged states	13	281.96	281.83	0.05				0	PASS	
	14	282.45	282.34	0.04				0	PASS	
	15	282.21	282.07	0.05				0	PASS	
	16	282.14	282.02	0.04				0	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Vibration (T3)

2.Test Purpose: This test simulates vibration during transport.

3.Test Procedure:

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes.This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1gn is maintained until 18 Hz is reached.

The amplitude is then maintained at 0.8 mm(1.6 mm total excursion) and thefrequency increased until a peak acceleration of 8gn occurs (approximately 50Hz).A peak acceleration of 8 gn is then maintained until the frequency is increased to 200Hz.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2009/10/27

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention (%)(=>90	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	**282.02**	**282.08**	0.02	**12.62**	**12.61**	99.9	**0**	PASS	PASS
	2	**281.86**	**281.93**	0.02	**12.62**	**12.61**	99.9	**0**	PASS	
	3	**281.99**	**282.04**	0.02	**12.62**	**12.61**	99.9	**0**	PASS	
	4	**282.01**	**282.10**	0.03	**12.62**	**12.61**	99.9	**0**	PASS	
At first cycle,in fully discharged states	5	**281.84**	**281.93**	0.03				**0**	PASS	
	6	**282.22**	**282.30**	0.03				**0**	PASS	
	7	**282.20**	**282.28**	0.03				**0**	PASS	
	8	**282.24**	**282.31**	0.02				**0**	PASS	
After 50 cycles ending in fully charged states	9	**282.13**	**282.16**	0.01	**12.67**	**12.66**	99.9	**0**	PASS	
	10	**281.94**	**282.01**	0.02	**12.67**	**12.65**	99.8	**0**	PASS	
	11	**281.71**	**281.78**	0.02	**12.66**	**12.65**	99.9	**0**	PASS	
	12	**281.77**	**281.82**	0.02	**12.67**	**12.65**	99.8	**0**	PASS	
After 50 cycles ending in fully discharged states	13	**281.83**	**281.89**	0.02				**0**	PASS	
	14	**282.34**	**282.37**	0.01				**0**	PASS	
	15	**282.07**	**282.16**	0.03				**0**	PASS	
	16	**282.02**	**282.12**	0.04				**0**	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Shock (T4)

2.Test Purpose: This test simulates possible impacts during transport.

3.Test Procedure:

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of pack acceleration of 150 g_n and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

However, large cells and large batteries shall be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds. Each cell or battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2009/10/29

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention (%)(=>90	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	**282.08**	**282.07**	0.00	**12.61**	**12.61**	100.0	**0**	PASS	PASS
	2	**281.93**	**281.90**	0.01	**12.61**	**12.61**	100.0	**0**	PASS	
	3	**282.04**	**282.03**	0.00	**12.61**	**12.61**	100.0	**0**	PASS	
	4	**282.10**	**282.09**	0.00	**12.61**	**12.61**	100.0	**0**	PASS	
At first cycle,in fully discharged states	5	**281.93**	**281.93**	0.00				**0**	PASS	
	6	**282.30**	**282.31**	0.00				**0**	PASS	
	7	**282.28**	**282.30**	0.01				**0**	PASS	
	8	**282.31**	**282.31**	0.00				**0**	PASS	
After 50 cycles ending in fully charged states	9	**282.16**	**282.19**	0.01	**12.66**	**12.65**	99.9	**0**	PASS	
	10	**282.01**	**282.00**	0.00	**12.65**	**12.65**	100.0	**0**	PASS	
	11	**281.78**	**281.77**	0.00	**12.65**	**12.64**	99.9	**0**	PASS	
	12	**281.82**	**281.83**	0.00	**12.65**	**12.65**	100.0	**0**	PASS	
After 50 cycles ending in fully discharged states	13	**281.89**	**281.89**	0.00				**0**	PASS	
	14	**282.37**	**282.38**	0.00				**0**	PASS	
	15	**282.16**	**282.14**	0.01				**0**	PASS	
	16	**282.12**	**282.06**	0.02				**0**	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: External short circuit (T5)

2.Test Purpose: This test simulates an external short circuit.

3.Test Procedure:

The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 55±2℃ and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1ohm at 55±2 ℃.This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55±2 ℃. The cell or battery must be observed for a further six hours for the test to be concluded.

SANYO Internal Procedure:

As above.

4.Test Requirements:

External temperature of test batteries does not exceed 170 ℃ and there is no disassembly,no rupture and no fire within six hours of this test.

5.Test Date: 2009/11/4

6.Test Data

Battery No.		Maximum temperature (°C)	Other event	Result	Judgement
At first cycle,in fully charged states	1	55.9	0	PASS	PASS
	2	55.8	0	PASS	
	3	55.5	0	PASS	
	4	55.5	0	PASS	
At first cycle,in fully discharged states	5	55.2	0	PASS	
	6	55.3	0	PASS	
	7	55.3	0	PASS	
	8	55.4	0	PASS	
After 50 cycles ending in fully charged states	9	56.2	0	PASS	
	10	56.1	0	PASS	
	11	55.9	0	PASS	
	12	55.9	0	PASS	
After 50 cycles ending in fully discharged states	13	55.4	0	PASS	
	14	55.5	0	PASS	
	15	55.6	0	PASS	
	16	55.5	0	PASS	

Notes: D-Disassembly, R-Rupture, F-Fire, 0-No disassembly, no rupture & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Impact (T6)

2.Test Purpose: This test simulates an impact.

3.Test Procedure:

The test sample cell or component cell is to be placed on a flat surface. A 15.8mm diameter bar is to be placed across the center of the sample. A 9.1kg mass is to be dropped from a height of 61±2.5cm onto the sample.

A cylindrical or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm diameter curved surface lying across the centre of the test sample. A prismatic cell is also to be rotated 90 degrees around its longitudinal axis so that both the wide and narrow sides will be subjected to the impact. Each sample is to be subjected to only a single impact. Separate samples are to be used for each impact.

A coin or button cell is to be impacted with the flat surface of the sample parallel to the flat surface and the 15.8mm diameter curved surface lying across its center.

SANYO Internal Procedure:

As above.

4.Test Requirements:

External temperature of test batteries does not exceed 170°C and there is no disassembly and no fire within six hours of this test.

5.Test Date: 2009/7/22

6.Test Data:

Cell No.		Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, 50% charged states	1	146	**0**	**PASS**	**PASS**
	2	144	**0**	**PASS**	
	3	138	**0**	**PASS**	
	4	138	**0**	**PASS**	
	5	140	**0**	**PASS**	
	6				
	7				
	8				
	9				
	10				
After 50 cycles ending, in fully discharged states	11	45	**0**	**PASS**	
	12	61	**0**	**PASS**	
	13	61	**0**	**PASS**	
	14	61	**0**	**PASS**	
	15	69	**0**	**PASS**	
	16				
	17				
	18				
	19				
	20				

Notes: D-Disassembly, F-Fire, 0-No disassembly & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Overcharge (T7)

2.Test Purpose: This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

3.Test Procedure:

The charge current shall be twice the manufacturer's recommended maximum continuous charge current.
The minimum voltage of the test shall be as follows:

(a) when the manufacturer's recommended charge voltage is not more than 18V,the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) when the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

SANYO Internal Procedure:

Min.Charge Voltage:	22 V
Charge Current:	2.64 A

4.Test Requirements:

There is no disassembly and no fire within seven days of the test.

5.Test Date: 2009/11/4

6.Test Data

Battery No.		Event	Result	Judgement
At first cycle in fully charged states	1	0	PASS	PASS
	2	0	PASS	
	3	0	PASS	
	4	0	PASS	
After 50 cycles ending in fully charged states	5	0	PASS	
	6	0	PASS	
	7	0	PASS	
	8	0	PASS	

Notes: D-Disassembly, F-Fire, 0-No disassembly & no fire

UN Test Data (Model:3LUNA-2-T0595)

1.Test Item: Drop Test

2.Test Purpose: This test simulates the drop of the packaging during transport.

3.Test Procedure:

Number of Test Samples (Per design type, Manufacturer) and Drop Orientation For other than flat drops the centre of gravity must be vertically over the point of impact. Where more than one orientation is possible for a given drops, the orientation most likely to result in failure of the packaging must be used.

Packaging	Number of test samples	Drop orientation
Boxes of natural wood Plywood boxes Reconstituted wood boxes Fibreboard boxes Plastic boxes Steel or aluminum boxes Composite Packagings which are in the shape of a box.	Five (one for each drop)	First drop: flat on the bottom Second drop: flat on the top Third drop: flat on the long side Fourth drop: flat on the short side Fifth drop: on a corner

SANYO Internal Procedure:

Packaging: Fiberboard boxes. Number of test samples: Five(one for each drop). It may do the drop of five orientations with one sample if the packing does not have the big damage.

Drop orientation: As above.

4.Test Requirements:

A Package passes the test if it meets the following criteria:

Each package is capable of withstanding a 1.2 meter drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell cell) contact and without release of contents.

5.Test Date: 2009/12/9

6.Test Data: PASS(Drop height 1.2m)

6-1. No any package crack
6-2. No any cell damege and battery damage.
6-3. No any out side release of contents from shipping box
6-4. No any contact between battery and battery, cell and cell.

Packaging size:
546*304*152mm
Packaging weight (before):
9.6kg
Packaging weight (after):
9.6kg